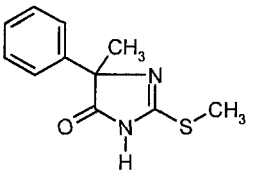
Data Evaluation Report on the adsorption-desorption of the fenamidone metabolite RPA 412708 in soil

PMRA Submission Number {.....} EPA MRID Number 45385825

Data Requirement: PMRA Data Code:
EPA DP Barcode:
OECD Data Point:
EPA Guideline: 163-1

Test material:
Common name: RPA 412708 (metabolite of fenamidone)
Chemical name
IUPAC: (S)-5-methyl-2-methylthio-5-phenyl-3,5-dihydroimidazol-4-one
CAS name: 4H-imidazol-4-one-3,5-dihydro-5-methyl-2-(methylthio)-5-phenyl-,(S)
CAS No: Not registered (p. 13)
Synonyms: S-enantiomer of the racemic compound RPA 408056
SMILES string:

Chemical Structure:



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August, 26/2002

Company Code: [for PMRA]
Active Code: [for PMRA]
Use Site Category: [for PMRA]
EPA PC Code: 046679

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CITATION: Burr, C.M. 1999. [^{14}C]-RPA 412708 : Adsorption/desorption to and from four soils and a sediment. Unpublished study performed and sponsored by Rhône-Poulenc Agriculture Ltd., Essex, UK. Laboratory Project ID. 14708. RPA Document 202054. Study initiated November 4, 1998 and completed June 30, 1999.

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Administrative conclusions: This study is acceptable and provides mobility information on the metabolite RPA 412708. This study together with the studies conducted with parent fenamidone and three other metabolites may be used to satisfy the 163-1 data requirement. The requirement for a mobility study using fenamidone as the test substance is satisfied by MRID 45385823.

EXECUTIVE SUMMARY:

The adsorption/desorption characteristics of the fenamidone metabolite [phenyl-U-^{14}C]RPA 412708 [(S)-5-methyl-2-methylthio-5-phenyl-3,5-dihydroimidazol-4-one] was studied in a silt loam soil [pH- 6.2, organic carbon - 0.5%] and sandy loam soil [pH - 6.7, organic carbon - 1.2%], each from the U.S., and a silt loam soil [pH - 8.1, organic carbon - 1.9%], clay sediment [pH - 7.4, organic carbon - 3.4%], and loam soil [pH - 7.8, organic carbon - 2.0%], each from the UK, in a batch equilibrium experiment. The experiment was conducted in accordance with the U.S. EPA Pesticide Guidelines Subdivision N, 163-1 and OECD Guidelines for Testing of Chemicals, "Adsorption/Desorption", Guideline 106 (May, 1981), and in compliance with the GLP standard 40 CFR Part 160 and OECD-GLP. The adsorption phase of the study was carried out by equilibrating air-dried soil and sediment with RPA 412708 at nominal concentrations of 15.0, 3.0, 0.6, 0.12 mg a.i./kg at 20 ± 1°C for 24 hours in the dark. The equilibrating solution used was 0.01 M $CaCl_2$, with soil/solution ratios of 1:3 (w:v) for all four soils and one sediment. The desorption phase of the study was carried out by replacing the adsorption solution with an equivalent volume of sterilized, pesticide-free 0.01 M $CaCl_2$ solution and equilibrating in the dark for 1 hour at 20°C. The desorption phase was repeated four times.

The supernatant solution after adsorption and desorption was separated by centrifugation and triplicate aliquots were analysed for total radioactivity using LSC. Following desorption, 1 sample of each soil and sediment was extracted with acetonitrile:water and triplicate aliquots were analyzed by LSC. Radioactivity in the soil residue after the desorption or extraction step was determined by combustion. Aliquots (0.1-0.3 g) of soil were combusted and analyzed by LSC.

HPLC analysis of supernatants from the soil residues indicated that RPA 412708 was stable in the test solutions during the adsorption/desorption phase of the experiment. Supernatants analyzed by HPLC were from the highest treatment concentration. The mass balance was not reported at the end of adsorption phase of the study. The complete mass balance (adsorption and five desorption steps) was 100.3%, 100.9%, 97.9%, 99.2% and 97.2% of the applied in the

Bosket silt loam soil, sandy loam soil, Panholes silt loam soil, clay sediment and loam soil, respectively.

After 24 hours of equilibration, 7.50-10.05%, 9.64-17.64%, 9.42-16.42%, 13.61-15.51%, and 13.56-25.30% of the applied RPA 412708 was adsorbed to the Bosket silt loam soil, sandy loam soil, Panholes silt loam soil, clay sediment and loam soil, respectively (reviewer-calculated). Freundlich K_{ads} values were 0.26, 0.38, 0.40, 0.51, and 0.65 for the Bosket silt loam soil, sandy loam soil, Panholes silt loam soil, clay sediment and loam soil, respectively. Corresponding adsorption K_{oc} values ranged from 15 to 52. At the end of the desorption phase, 95.4-96.8%, 84.7-95.2%, 84.7-92.2%, 94.8-96.8%, and 83.0-91.3% of the adsorbed amount was desorbed from the Bosket silt loam soil, sandy loam soil, Panholes silt loam soil, sediment and loam soil, respectively (reviewer-calculated). At the end of the desorption phase, Freundlich K_{des} values were 0.77, 7.65, 105.32, 47.59, and 26.94 for the Bosket silt loam soil, sandy loam soil, Panholes silt loam soil, clay sediment and loam soil, respectively; corresponding K_{oc} values ranged from 153 to 5543. Freundlich K_{des} and K_{oc} values were higher than those obtained for adsorption.

Results Synopsis: Adsorption and desorption values determined using Freundlich isotherm equations. Amounts adsorbed and desorbed were calculated by the reviewer.

Soil type: Bosket silt loam
Amount adsorbed: 7.50-10.05%
Adsorption K_{ads}: 0.26
Adsorption K_{oc}: 52
Amount desorbed: 95.4-96.8% of the adsorbed
Desorption K_d: 0.77
Desorption K_{oc}: 153

Soil type: Sandy loam
Amount adsorbed: 9.64-17.64% of the applied
Adsorption K_d: 0.38
Adsorption K_{oc}: 32
Amount desorbed: 84.7-95.2% of the adsorbed
Desorption K_d: 7.65
Desorption K_{oc}: 638

Soil type: Panholes silt loam
Amount adsorbed: 9.42-16.42% of the applied

Adsorption K_d: 0.40
Adsorption K_{oc}: 21
Amount desorbed: 84.7-92.2% of the adsorbed
Desorption K_d: 105.32
Desorption K_{oc}: 5543

Soil type: Clay sediment
Amount adsorbed: 13.61-15.51% of the applied
Adsorption K_d: 0.51
Adsorption K_{oc}: 15
Amount desorbed: 94.8-96.8% of the adsorbed
Desorption K_d: 47.59
Desorption K_{oc}: 1400

Soil type: Loam
Amount adsorbed: 13.56-25.30% of the applied
Adsorption K_d: 0.65
Adsorption K_{oc}: 33
Amount desorbed: 83.0-91.3% of the adsorbed
Desorption K_d: 26.94
Desorption K_{oc}: 1347

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED: The study was conducted according to U.S. EPA Pesticide Assessment Guidelines Subdivision N, Series §163-1 (October 1982) and the EU Commission Directive 95/36/EC (July 1995). No deviations affected the validity of the study. Deviations from Subdivision N guidelines are:

The study was conducted using a metabolite rather than the parent compound.

COMPLIANCE: This study was conducted in compliance with 40 CFR Part 160,

EPA GLP and OECD-GLP. Signed and dated GLP, Quality Assurance, Data Confidentiality, and Study Certification statements were provided.

A. MATERIALS:

1. Test Material RPA 412708

Chemical Structure:

Description: Solid

Purity: Analytical purity: 100% Lot/Batch No.: Not provided
Radiochemical purity: >99% (p. 13)
Batch No.: PCH1521
Specific activity: 1330 Mbq mmol
Locations of the label: Uniformly labeled in the phenyl ring

Storage conditions of test chemicals: Not provided

Physico-chemical properties of RPA 412708:

Parameter	Values	Comments
Water solubility	>10 mg/L	
Vapour pressure	Not provided	
UV absorption	Not provided	
pK_a	Not provided	
K_{ow}	Not provided	
Stability of Compound at room temperatre	Not provided	

Data were obtained from Appendix 3, p. 90 of the study report.

2. Soil Characteristics

Table 1: Description of soil collection and storage.

Description	Silt loam	Sandy loam	Clay sediment	Silt loam	Loam
Geographic location	Leland, MS	Iola, Wisconsin	Essex, UK	Kent, UK	Essex, UK
Pesticide use history at the collection site	Not provided	Not provided	Not provided	Not provided	Not provided
Collection procedures	Not provided	Not provided	Not provided	Not provided	Not provided
Sampling depth (cm)	Not provided	Not provided	Not provided	Not provided	Not provided
Storage conditions	Not provided	Not provided	Not provided	Not provided	Not provided
Storage length	Not provided	Not provided	Not provided	Not provided	Not provided
Soil preparation	Sieved, 2 mm	Sieved, 2 mm	Sieved, 2 mm	Sieved, 2 mm	Sieved, 2 mm

Data were obtained from p. 14 and Table 1, p. 30 of the study report.

Table 2: Properties of the soils.

Property	Bosket 96/19	Rosholt 96/44	Panholes 97/10	Sediment 97/17	Faulkbourne 98/09
Soil Texture	Silt loam	Sandy loam	Silt loam	Clay	Loam
% sand	35.80	64.17	20.90	20.03	36.09
% silt	55.97	29.11	54.79	36.49	40.76
% clay	8.23	6.72	24.31	43.49	23.15
pH	6.2	6.7	8.1	7.4	7.8
Organic carbon (%)	0.5	1.2	1.9	3.4	2.0
CEC (meq/100 g)	5.7	6.5	65.7	62.3	12.2
Moisture at 1/3 atm (%)	25.41	20.66	25.86	31.25	21.00
Bulk density (lb/cu ft^3)	Not provided	Not provided	Not provided	Not provided	Not provided
Biomass (mg microbial C/100 g)	Not provided	Not provided	Not provided	Not provided	Not provided
Soil taxonomic classification	Fine-loamy, mixed, thermic mollic hapludalfs	Coarse-loamy, mixed typic glossoboralfs	Fine-silty, mixed, mesic typic eutrochrept	Not provided	Fine-loamy, mixed, mesic typic hapludalfs
Soil mapping unit (for EPA)	Not provided	Not provided	Not provided	Not provided	Not provided

Data were obtained from Table 1, p. 30 and Appendix 8, pp. 115-117 of the study report.

B. STUDY DESIGN:

1. Preliminary study: To determine whether the test substance adsorbed to borosilicate screw-capped glass tubes, one set of two tubes was soaked overnight in 0.1M HCl, rinsed with deionized water, and air-dried prior to use. A second set of two tubes without prepreparation was also designated for treatment. All tubes were externally coated with plastic. To each set of tubes, 75 mL of a solution containing 1 mg/L of [^{14}C]RPA 412708 in 0.01M $CaCl_2$ was added, and the tubes were tightly capped and shaken on an end-over-end shaker in the dark at 20 ± 1°C for 24

hours. Aliquots of the solution were analyzed for total radioactivity using LSC (p. 15). Results showed that adsorption of the test substance to the tube walls was higher in the unwashed tubes; mean recoveries for the unwashed tubes were 94.55% (93.9-95.2%) and for the acid-washed tubes were 98.75% (98.3-99.2%; Table 3, p. 31).

To determine the soil:solution ratio to be used in the definitive study, soil:solution ratios of 1:10, 1:5 and 1:3 were prepared by adding aliquots of a solution containing 1 mg/L of [^{14}C]RPA 412708 in 0.01M $CaCl_2$ to acid-treated borosilicate screw-capped glass tubes containing 6, 15, and 20 g (dry weight equivalent) of each test soil and sediment (p. 15). The tubes were tightly capped, shaken by hand to suspend the soil, then shaken on an end-over-end shaker in the dark at 20 ± 1°C for 24 hours. The tubes were removed and centrifuged for 10 minutes at 2,000 rpm. Aliquots of the supernatants were analyzed for total radioactivity using LSC. Soil:solution ratios of 1:3 yielded recoveries of 71.6-82.3% of the applied in the supernatants (Table 4, p. 32). Soil:solution ratios of 1:5 and 1:10 yielded recoveries of 82.7-89.9% and 92.0-95.9% of the applied, respectively, in the supernatants.

To determine the equilibration time to be used in the definitive adsorption phase of the study, 60 mL of a 0.01 M $CaCl_2$ solution containing 1 mg/L of [^{14}C]RPA 412708 were added to borosilicate screw-capped glass tubes containing 20 g (dry weight equivalent) of each test soil and sediment (p. 16). The tubes were shaken by hand to suspend the soil, then shaken on an end-over-end shaker in the dark at 20 ± 1° C for 1, 2, 4, 6, 24, and 48 hours. The samples were centrifuged at 2,000 rpm for 10 minutes and triplicate aliquots of the supernatants were analyzed for total radioactivity using LSC. Results showed an initial, rapid decrease in radioactivity in the supernatants, that was followed by a gradual decrease, then little change after 24 hours (p. 22; Figure 1, p. 50).

To determine the equilibration time to be used in the definitive desorption phase of the study, 60 mL of a 0.01 M $CaCl_2$ solution containing l mg/L of [^{14}C]RPA 412708 were added to borosilicate screw-capped glass tubes containing 20 g (dry weight equivalent) of each test soil and sediment (p. 17). The tubes were tightly capped, shaken by hand to suspend the soil, then shaken on an end-over-end shaker in the dark at 20 ± 1° C for 24 hours. The samples were centrifuged and the supernatants were decanted and replaced with pesticide-free 0.01M $CaCl_2$. The tubes were then placed in the dark at 20°C and shaken on an end-over-end shaker for 1, 2, 4, 6, and 24 hours (p. 18). The samples were centrifuged at 2,000 rpm for 10 minutes and triplicate aliquots of the supernatants were analyzed for total radioactivity using LSC. In the four test soils and one sediment, the amount of radioactivity in solution was similar between 1 hour and 24 hours (p. 22; Figure 2, p. 50).

To determine the solubility of RPA 412708, approximately 1.3 mg of RPA 412708 was weighed into a 50-mL volumetric flask and 50 mL of deionized water was added to the flask (Appendix 3, p. 90). The solution was mixed in an ultrasonic bath for approximately 24 hours at 20°C, then filtered (0.45 µm); aliquots were analyzed using LSC. The solution was re-filtered (0.1 µm) and the radioactivity was determined using LSC. The solubility of RPA 412636 was determined to be >10 mg/L.

Based on the results of the preliminary studies, it was determined that acid pretreatment reduced adsorption of the test substance to glass and acid-treated glassware would be used in the definitive study. Based on the preliminary study results, it was also determined that the definitive study would be conducted using a soil:solution ratio of 1:3, an adsorption phase equilibration period of 24 hours, a desorption phase equilibration period of 1 hour, and a maximum solution concentration of 5 mg/L for each of the test soils and sediment (p. 22; Appendix 3, p.90).

2. Definitive study experimental conditions:

Table 3: Study design for the adsorption phase.

Parameters		Bosket silt loam	Sandy loam	Panholes silt loam	Clay sediment	Loam
Condition of soil (air dried/fresh)		Air-dried	Air-dried	Air-dried	Air-dried	Air-dried
Have these soils been used for other laboratory studies ? (specify which)		Yes, MRIDs 45385823, 45385824, 45385826, 45385828	Yes, MRIDs 45385823, 45385824, 45385826	Yes, MRIDs 45385823, 45385824, 45385826	Yes, MRID 45385826	Yes, MRIDs 45385823, 45385824, 45385826, 45385828
Soil (g/replicate)		20 g	20 g	20 g	20 g	20 g
Equilibrium solution used (name and concentration; eg: 0.01N $CaCl_2$)		0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$
Control used (with salt solution only) (Yes/No)		No	No	No	No	No
Test material concentrations[1]	Nominal application rates (mg/kg)	15.0, 3.0, 0.6, 0.12	15.0, 3.0, 0.6, 0.12	15.0, 3.0, 0.6, 0.12	15.0, 3.0, 0.6, 0.12	15.0, 3.0, 0.6, 0.12 0.04
	Analytically measured concentrations (mg/kg)	13.3, 2.6, 0.51, 0.11	13.3, 2.6, 0.51, 0.11	13.4, 2.6, 0.51, 0.11	13.4, 2.6, 0.51, 0.11	13.5, 2.7, 0.52, 0.11
Identity and concentration of co-solvent, if any		None	None	None	None	None
Soil:solution ratio		1:3	1:3	1:3	1:3	1:3
Initial pH of the equilibration solution, if provided		Not provided	Not provided	Not provided	Not provided	Not provided

Parameters		Bosket silt loam	Sandy loam	Panholes silt loam	Clay sediment	Loam
No. of replica-tions	Controls	0	0	0	0	0
	Treatments	2	2	2	2	2
Equilibration	Time (hours)	24	24	24	24	24
	Temperature (°C)	20 ± 1	20 ± 1	20 ± 1	20 ± 1	20 ± 1
	Darkness (Yes/No)	Yes	Yes	Yes	Yes	Yes
	Shaking method	End-over-end shaker	End-over-end shaker	End-over-end shaker	End-over-end shaker	End-over-end shaker
	Shaking time (hours)	24	24	24	24	24
Method of separation of supernatant (eg., centrifugation)		Decantation	Decantation	Decantation	Decantation	Decantation
Centrifugation	Speed (rpm)	2,000	2,000	2,000	2,000	2,000
	Duration (min)	*ca.* 10	*ca.* 10	*ca.* 10	*ca.* 10	*ca.* 10
	Method of separation of soil and solution	Not reported	Not reported	Not reported	Not reported	Not reported

Data were obtained from pp. 15, 19, Table 5, p. 32 of the study report.

[1] Reviewer-calculated by multiplying the concentration (nominal/measured) by the volume of $CaCl_2$ solution used and dividing that number by the amount of soil used in the system (5 mg/L x 60 mL = 300 mg/20 g soil = 15 mg/kg).

Table 4: Study design for the desorption phase.

Parameters		Bosket silt loam	Sandy loam	Sediment	Panholes silt loam	Loam
Were the soil residues from the adsorption phase used? If not, describe the method for adsorption using a separate adsorption Table		Yes	Yes	Yes	Yes	Yes
Amount of test material present in the adsorbed state/adsorbed amount (mg a.i./kg soil)[1]	15.0	0.9873	1.2401	1.2265	1.7630	1.8089
	3.0	0.1953	0.2942	0.2902	0.3889	0.5491
	0.6	0.0456	0.0687	0.0804	0.0773	0.1155
	0.12	0.0107	0.0185	0.01479*	0.0163	0.0277
No. of desorption cycles		5	5	5	5	5
Equilibration solution and quantity used per treatment for desorption (eg., 0.01M $CaCl_2$)		0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$
Soil:solution ratio		1:3	1:3	1:3	1:3	1:3
Replications	Controls	0	0	0	0	0
	Treatments	2	2	2	2	2
Desorption equilibration	Time (hours)	1	1	1	1	1
	Temperature (°C)	20 ± 1	20 ± 1	20 ± 1	20 ± 1	20 ± 1
	Darkness	Yes	Yes	Yes	Yes	Yes

Parameters		Bosket silt loam	Sandy loam	Sediment	Panholes silt loam	Loam
	Shaking method	End-over-end shaker	End-over-end shaker	End-over-end shaker	End-over-end shaker	End-over-end shaker
	Shaking time (hours)	1	1	1	1	1
Centrifugation	Speed (rpm)	2,000	2,000	2,000	2,000	2,000
	Duration (min)	10	10	10	10	10
	Method of separation of soil and solution	Not reported	Not reported	Not reported	Not reported	Not reported
Second - fifth desorption	Indicate if the method is same as the first desorption cycle.	Same	Same	Same	Same	Same

Data obtained from p. 19 of the study report.
[1] Means were reviewer-calculated using Excel and data obtained from Tables 8-12, pp. 34-35 of the study report.
* Value is a single replicate due to breakage of one tube.

3. Description of analytical procedures:

Extraction/clean up/concentration methods: Following the final desorption step, 75 mL of acetonitrile:water (50:50, v:v) was added to one tube from each test soil and sediment and the tube was shaken to resuspend the soil (p. 19). The tubes were shaken on a wrist action shaker for 20 minutes, centrifuged for 10 minutes, and the supernatants were removed (method unspecified).

Total ^{14}C measurement: Triplicate aliquots of the supernatants were analyzed for total radioactivity using LSC. Following the final desorption or extraction, the soil residues were air-dried, ground to a fine powder, and triplicate subsamples (0.1-0.3 g) were analyzed for total radioactivity by LSC following combustion (p. 20).

Non-extractable residues, if any: Not applicable.

Derivatization method, if used: A derivatization method was not employed in the study.

Identification and quantification of parent compound: Supernatants analyzed by HPLC were from the highest treatment concentration. Identification and quantification of RPA 412708 were performed by HPLC using the following operating conditions: Kromasil KR 100 5C1 column (4.6 x 250 mm), isocratic mobile phase of acetonitrile:water (20:80, v:v), flow rate 1 mL/minute, with radiometric and UV (230 nm) detection (p. 20). The identity of RPA 412708 was confirmed by chromatographic comparison of the HPLC retention time of an unlabelled reference standard.

Identification and quantification of transformation products, if appropriate: Identification and quantification of transformation products were not performed.

Detection limits (LOD, LOQ) for the parent compound: The limit of detection for LSC and HPLC analyses of RPA 412708 were reported to be 0.00222 ng/g and 0.0099 µg/g, respectively Appendix 9, p. 119). The limits of quantification for LSC and HPLC analyses were not reported.

Detection limits (LOD, LOQ) for the transformation products, if appropriate: Identification and quantification of transformation products were not performed.

II. RESULTS AND DISCUSSION

A. TEST CONDITIONS: RPA 412708 was relatively stable in the four test soils and one sediment; degradation was ≤2.69% of the applied in all supernatants analyzed (p. 25; Table 18, pp. 45-46).

B. MASS BALANCE: The mass balance was not reported at the end of adsorption phase of the study. Mass balances were calculated by summing the total amount of RPA 412708 recovered in the adsorption and desorption solutions, the soil extracts, and unextracted soil residues. Mass balances were 100.3, 100.9, 97.9, 99.2, and 97.2% of the applied for the Bosket silt loam, sandy loam, Panholes silt loam soil, clay sediment and loam soil, respectively (Tables 19-23, pp. 47-48).

Table 5: Recovery of RPA 412708, expressed as percentage of applied radioactivity, in soil after adsorption/desorption (n = 2; mean ± s.d.)[1].

Matrices	Bosket silt loam	Sandy loam	Clay sediment	Panholes silt loam	Loam
At the end of the adsorption phase					
Supernatant solution	78.7 ± 1.4	75.00 ± 2.7	69.4 ± 6.2	65.3 ± 0.9	64.1 ± 4.1
Solid phase (total ^{14}C)	Not determined				
Total recovery	Not determined				
At the end of the desorption phase					
Supernatant solution[2]	20.64 ± 1.0	22.77 ± 1.4	23.84 ± 1.2	32.43 ± 1.1	28.75 ± 1.5
Solid phase (extracted) [3]	--	--	--	--	--
Non-extractable residues in soil, if measured[3]	0.89 ± 0.2	3.06 ± 1.2	3.39 ± 1.1	1.54 ± 0.4	4.59 ± 1.4
Total recovery	100.3 ± 0.8	100.9 ± 0.7	97.9 ± 1.6	99.2 ± 0.6	97.2 ± 1.5

[1] Means and standard deviations were reviewer-calculated using Excel and data obtained from Tables 19-23, pp. 47-48 of the study report.

[2] Values represent cumulative radioactivity in desorption supernatants for all five desorption steps.

[3] Single samples were extracted, the extracted and non-extractable values for these single samples are not included in the table. The respective extracted and non-extractable values are 0.3% and 0.5% for the Bosket silt loam soil; 0.4% and 1.4% for the sandy loam soil; 0.5% and 1.5% for the Panholes silt loam soil; 0.0% and 1.1% for the sediment; and 1.1% and 1.6% for the loam soil.

Table 6: Concentration of RPA 412708 in the solid and liquid phases at the end of adsorption equilibration period (n = 2; mean ± s.d.)[1]

Concentration (mg a.i./kg)	Bosket silt loam			Sandy loam			Panholes silt loam		
	on soil (mg a.i./kg)[2]	in solution (µg a.i./mL)	% adsorbed[3]	on soil (mg a.i./kg)[2]	in solution (µg a.i./mL)	% adsorbed[3]	on soil (mg a.i./kg)[2]	in solution (µg a.i./mL)	% adsorbed[3]
15.0	0.9873 ± 0.1	4.0106 ± 0.0	7.67 ± 0.6	1.2401 ± 0.0	3.8705 ±0.0	9.64 ± 0.7	1.2265 ±0.0	3.7818 ±0.0	9.42 ± 0.8
3.0	0.1953 ± 0.0	0.7863 ± 0.0	7.50 ± 0.1	0.2942 ± 0.0	0.742 ± 0.0	11.54 ± 0.0	0.2902 ±0.0	0.7197 ±0.0	11.28 ± 0.1
0.6	0.0456 ± 0.0	0.1520 ± 0.0	9.69*	0.0687 ± 0.0	0.142 ± 0.0	13.99 ± 2.3	0.0804 ±0.0	0.1320 ±0.0	16.42 ± 3.5
0.12	0.0107 ± 0.0	0.0321 ± 0.0	10.05 ± 2.1	0.0185 ± 0.0	0.029 ± 0.0	17.64 ± 0.3	0.0148*	0.02852*	14.7*

Concentration (mg a.i/kg)	Clay sediment			Loam		
	on soil (mg a.i./kg)[2]	in solution (µg a.i./mL)	% adsorbed[3]	on soil (mg a.i./kg)[2]	in solution (µg a.i./mL)	% adsorbed[3]
15.0	1.7630 ± 0.1	3.7262 ± 0.0	13.61 ± 0.6	1.8089 ± 0.0	3.7290 ± 0.0	13.56 ± 1.1
3.0	0.3889 ± 0.0	0.7199 ± 0.0	14.90 ± 0.0	0.5491 ± 0.0	0.6813 ± 0.0	20.60 ± 0.3
0.6	0.0773 ± 0.0	0.1387 ± 0.0	15.51 ± 0.3	0.1155 ± 0.0	0.1273 ± 0.0	23.11 ± 1.4
0.12	0.0163 ± 0.0	0.0292 ± 0.0	15.45 ± 0.2	0.0277 ± 0.0	0.0263 ± 0.0	25.30 ± 0.6

[1] Means and standard deviations were reviewer-calculated using Excel and data obtained from Tables 8-12, pp. 34-35 and Appendix 5, pp. 93-101 of the study

[2] Reviewer calculated by dividing soil concentration by treatment rate (1.048 µg/g x 20 g soil ÷ 258.068 µg = 8.1%)

[3] The amount adsorbed was calculated by the reviewer as the difference between the amount applied and the amount in the aqueous phase.

report.

* Data were reported for a single sample.

Table 7: Concentration of RPA 412708 in the solid and liquid phases at the end of desorption (total of all desorption phases).[1, 2]

Concentration (mg a.i/kg)	Silt loam			Sandy loam			Silt loam		
	on soil (mg a.i./kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed[2]	on soil (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed[2]	on soil (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed[1]
15.0	0.1830	0.7929	96.8	0.1418	0.9070	95.2	0.4490	0.9722	92.2
3.0	0.0122	0.1621	96.1	0.0277	0.1875	90.7	0.1069	0.1975	89.5
0.6	0.0076	0.0323	95.9	0.0096	0.0384	88.0	0.0354	0.0399	87.5
0.12	0.0020	0.0071	95.4	0.0040	0.0086	84.7	0.0051	0.0086	84.7

Concentration (mg a.i/kg)	Clay sediment			Loam		
	on soil (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed[1]	on soil (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed[1]
15.0	0.2956	1.3456	96.8	0.4110	1.1882	91.3
3.0	0.0649	0.2735	96.1	0.2065	0.2462	88.6
0.6	0.0113	0.0538	95.5	0.0402	0.0495	85.9
0.12	0.0018	0.0116	94.8	0.0103	0.0109	83.0

[1] Means were reviewer-calculated using Excel and data obtained from Tables 13-17, pp. 36-44 of the study report.

[2] Each value in the solid phase is the amount present after the final desorption step and each value in the solution phase is the total amount desorbed; Total amount in solution during the 2-5 desorptions reviewer calculated by summing amount in solution at each desorption 0.66828+0.12487.

1 The % desorbed as % of the adsorbed was calculated for each sample by the reviewer as follows; [% desorbed (desorption 1 + desorption 2 + desorption 3 + desorption 4 + desorption 5)] ÷ (% total recovery - % adsorbed); *e.g.*, 99.4 - 79.0 = 20.4; 15.8 + 2.9 + 0.7 + 0.2 + 0.1 = 19.7; (19.7 ÷ 20.4) x 100= 96.6%

Table 8: Freundlich adsorption and desorption constants of RPA 412708 in the soils.[1]

Soil	Adsorption				Desorption[2]			
	K	1/N	R^2	K_{oc}	K_d	1/N	R^2	K_{oc}
Bosket silt loam	0.26	0.933	1.000	52	0.77	0.932	0.924	153
Sandy loam	0.38	0.862	1.000	32	7.65	0.895	0.961	638
Panholes silt loam	0.40	0.888	0.995	21	105.32	1.093	0.991	5543
Clay sediment	0.51	0.967	1.000	15	47.59	1.137	0.998	1400
Loam	0.65	0.852	0.996	33	26.94	0.943	0.980	1347

[1] Data were obtained from Tables 6-7, p. 33 of the study report.
[2] Desorption values reported for fifth desorption step.
K - Freundlich adsorption and desorption coefficients; 1/N -Slope of Freundlich adsorption/desorption isotherms.
K_{oc} - Coefficient adsorption per organic carbon (K_d or K x 100/% organic carbon).
R^2 - Regression coefficient of Freundlich equation.

C. ADSORPTION: After 48 hours of equilibration, 7.50-10.05%, 9.64-17.64%, 9.42-16.42%, 13.61-15.51%, and 13.56-25.30% of the applied RPA 412708 was adsorbed from the Bosket silt loam soil, sandy loam soil, Panholes silt loam, clay sediment and loam soil, respectively (reviewer-calculated). Freundlich K_{ads} values were 0.26, 0.38, 0.40, 0.51, and 0.65 for the Bosket silt loam soil, sandy loam soil, Panholes silt loam soil, clay sediment, and loam soil, respectively; corresponding K_{oc} values were 52, 32, 21, 15, and 33 (Table 6, p. 33).

D. DESORPTION: At the end of the desorption phase, 95.4-96.8%, 84.7-95.2%, 84.7-92.2%, 94.8-96.8%, and 83.0-91.3% of the adsorbed ^{14}C was desorbed from the silt loamsoil, sandy loam soil, silt loam soil, clay sediment, and loam soil, respectively (reviewer-calculated). Following the last desorption step, Freundlich K_{des} values were 0.77, 7.65, 105.32, 47.59, and 26.94 for the Bosket silt loam soil, sandy loam soil, Panholes silt loam soil, clay sediment, and loam soil, respectively; corresponding desorption K_{oc} values were 153, 638, 5543, 1400, and 1347 (Table 7, p. 33).

III. STUDY DEFICIENCIES: The objective of this study was to study the sorptive behaviour of the fenamidone metabolite RPA 412708 in four soils and one sediment with varying soil characteristics. None of the study deficiencies noted are considered to be of sufficient concern to cause the study to be judged scientifically invalid. However, since a metabolite of fenamidone was studied rather than the parent compound, this study cannot be used to fulfill Subdivision N

Guideline §163-1. This study does provide useful supplemental information on the mobility of RPA 412708 in four soils and a sediment.

IV. REVIEWER'S COMMENTS:

1. The Panholes silt loam and loam soils and the clay sediment were foreign in origin. However, these soils and sediment were characterized according to the USDA soil textural classification system and were comparable to soils found in the United States.

2. The 1/n values associated with the Freundlich K values for three of the test soils were below 0.9; l/n values associated with the Freundlich K_{ads} were 0.852-0.888 for the sandy loam, Panholes silt loam, and loam soils, respectively (study report Table 6, p. 33). If the 1/n value is not within the range of 0.9 to 1.1, then the Freundlich isotherm may not adequately or accurately represent the adsorption of the compound across all concentrations.

3. The reviewer notes that similar to the fenamidone metabolite, RPA 412636 (reviewed in this submission, MRID 4538525), the relationship between the test concentration of RPA 412708 and adsorption was non-linear for all of the test soils, whereas for the sediment, increased test concentration resulted in increased adsorption. Once RPA 412708 adsorbed to the test soil, it was less readily desorbed. The study author concluded that movement of RPA 412708 in the field could be less at lower concentrations than predicted by the adsorption isotherms (p. 26). Similar behavior was noted for the mobility of fenamidone and other fenamidone transformation products (reviews included in this submission).

4. The amount of RPA 412708 (µg) adsorbed to the soils and sediment was calculated as the difference between the amount applied and the amount in the supernatant solution.

5. The Bosket silt loam desorption coefficients were calculated using the second desorption (p. 25). For this soil, no values could be calculated for desorption steps 3-5 because no RPA remained adsorbed to some of these soil samples.

6. Sample storage intervals and conditions were not reported. Based on study report Table 2, the supernatants were stored up to 1 day prior to HPLC analysis (p. 31).

7. Control samples were not employed in the definitive study.

8. Method detection limits were not reported. Both method detection limits and limits of

quantitation should be reported to allow the reviewer to evaluate the adequacy of the method.

V. REFERENCES: The following references were cited in the study:

United States Environmental Protection Agency Pesticide Assessment Guidelines, Subdivision N, October 18, 1982.

EU Commission Directive 95/36/EC July 1995, amending Council Directive 91/414/EEC.

OECD Method 106, Paris 1981.

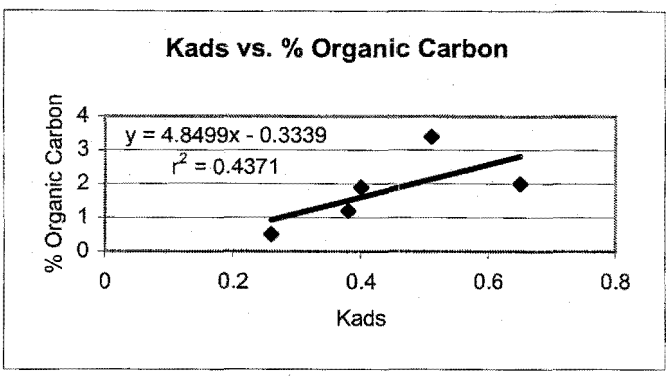
McCall, P.J., R.L. Swann, D.A. Laskowski, S.M. Unger, S.A. Vrona, and H.J. Dishburger. 1980. *Bull. Environ Contam. Toxicol.* 24, pp. 190-195.

Attachment 1

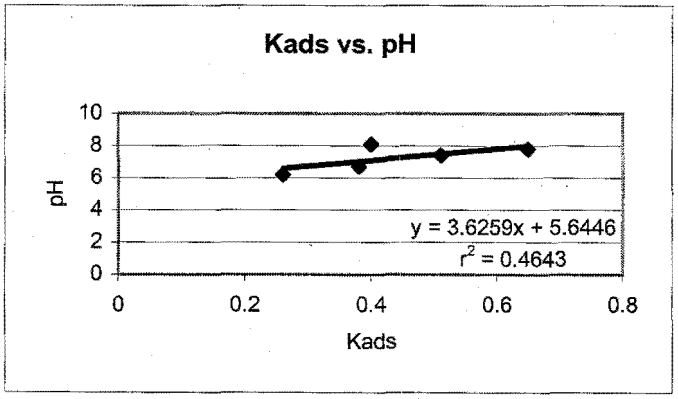
Excel Spreadsheets

Chemical Name	Fenamidone Metabolite RPA 412708
MRID	45385825
Guideline No.	163-1

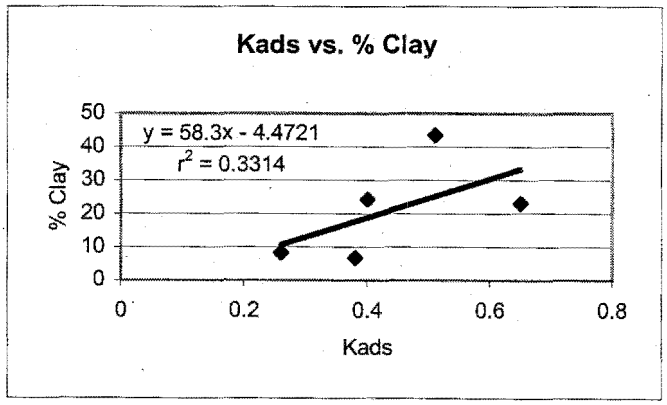
Soil	Kads	% Organic Carbon
Silt loam	0.26	0.5
Sandy loam	0.38	1.2
Silt loam	0.4	1.9
Sediment	0.51	3.4
Loam	0.65	2



Soil	Kads	pH
Silt loam	0.26	6.2
Sandy loam	0.38	6.7
Silt loam	0.4	8.1
Sediment	0.51	7.4
Loam	0.65	7.8



Soil	Kads	% Clay
Silt loam	0.26	8.23
Sandy loam	0.38	6.72
Silt loam	0.4	24.31
Sediment	0.51	43.49
Loam	0.65	23.15



Fenamindone Metabolite RPA 412708
163-1
MRID 45385825

Table 4/6

Adsorbed		Silt loam	Sandy loam	Silt loam	Sediment	Loam
	5	1.04817	1.17469	1.2867	1.7789	1.71677
	5	0.9265	1.3055	1.16624	1.74711	1.90102
	average	0.987335	1.240095	1.22647	1.763005	1.808895
	s.d.	0.086034	0.09249664	0.085178	0.022479	0.130284
	1	0.19386	0.29455	0.29341	0.38624	0.54014
	1	0.19672	0.29388	0.28689	0.39162	0.55813
	average	0.19529	0.294215	0.29015	0.38893	0.549135
	s.d.	0.002022	0.00047376	0.00461	0.003804	0.012721
	0.2	0.04752	0.06154	0.06818	0.07627	0.10917
	0.2	0.04369	0.0759	0.09255	0.07834	0.12187
	average	0.045605	0.06872	0.080365	0.077305	0.11552
	s.d.	0.002708	0.01015405	0.017232	0.001464	0.00898
	0.04	0.00947	0.01809	0.01479	0.01644	0.0279
	0.04	0.01194	0.01891	0.01479	0.01612	0.02748
	average	0.010705	0.0185	0.01479	0.01628	0.02769
	s.d.	0.001747	0.00057983	0	0.000226	0.000297

Table 5

Ads. Supernatant		Silt loam	Sandy loam	Silt loam	Sediment	Loam
	5	79	77.5	73.3	65.6	70.8
	5	79	77.6	74.8	66.8	69.4
	1	80.5	76.5	72.8	65.9	64.4
	1	79.9	76.5	72.6	65.8	64.1
	0.2	77.9	76.1	69.9	64.6	62.3
	0.2	78.8	72.8	66.3	65.1	61
	0.04	78.4	71.5	55.6	64.7	60
	0.04	75.9	71.3	69.5	64.1	60.6
	average	78.675	74.975	69.35	65.325	64.075
	s.d.	1.385383	2.65908147	6.169742	0.868085	4.052777

Table 5

Des. Supernatant		Silt loam	Sandy loam	Silt loam	Sediment	Loam
	5	19.7	21.4	22.7	31.8	26.5
	5	19.7	21.3	22.2	31.1	27.1
	1	19.7	22.4	23	31.7	27.9
	1	20.1	22.3	23.1	31.5	28
	0.2	21	23.2	24.7	32.9	30
	0.2	21	23.8	24.5	32.8	30.3
	0.04	21.8	25	25.1	33.5	30.2
	0.04	22.1	24.6	25.4	34.1	30
	average	20.6375	22.7714286	23.8375	32.425	28.75
	s.d.	0.976784	1.39078601	1.221167	1.059312	1.544576

Table 5
Combusted

	Silt loam	Sandy loam	Silt loam	Sediment	Loam
5	0.6	1.5	1.8	1	2.5
1	0.8	2.3	2.7	1.4	3.6
1	0.7	2.2	2.6	1.3	3.7
0.2	1	3.1	3.4	1.8	4.9
0.2	0.8	3.3	3.6	1.5	5
0.04	1.2	4	5.1	2.3	6.9
0.04	1.1	5	4.5	1.5	5.5
average	0.885714	3.05714286	3.385714	1.542857	4.585714
s.d.	0.219306	1.18723368	1.142262	0.411733	1.447329

Table 5
Recovery

	Silt loam	Sandy loam	Silt loam	Sediment	Loam
5	99.4	100.7	98	98.6	100
5	100.2	100.3	98.8	98.8	98.9
1	101	101.2	98.5	99	95.9
1	100.8	101.1	98.4	98.5	95.7
0.2	99.8	102.4	98	99.2	97.2
0.2	100.5	99.9	94.4	99.3	96.3
0.04	101.4	100.5	99.5	100.4	97.1
0.04	98.9	100.9		99.7	96.1
average	100.25	100.875	97.94286	99.1875	97.15
s.d.	0.845154	0.74976187	1.64505	0.626641	1.543651

Table 6
Solution

	Silt loam	Sandy loam	Silt loam	Sediment	Loam
5	3.99144	3.892	3.77406	3.70548	3.76225
5	4.02979	3.849	3.78953	3.74693	3.69582
average	4.010615	3.8705	3.781795	3.726205	3.729035
s.d.	0.027118	0.03040559	0.010939	0.02931	0.046973
1	0.78687	0.741	0.71985	0.7202	0.6825
1	0.78573	0.742	0.71962	0.71965	0.68017
average	0.7863	0.7415	0.719735	0.719925	0.681335
s.d.	0.000806	0.00070711	0.000163	0.000389	0.001648
0.2	0.15135	0.145	0.13579	0.13844	0.12854
0.2	0.15267	0.139	0.12817	0.13897	0.12614
average	0.15201	0.142	0.13198	0.138705	0.12734
s.d.	0.000933	0.00424264	0.005388	0.000375	0.001697
0.04	0.03254	0.029	0.005	0.02919	0.02625
0.04	0.03167	0.029	0.005	0.02913	0.02636
average	0.032105	0.029	0.005	0.02916	0.026305
s.d.	0.000615	0	0	4.24E-05	7.78E-05

Table 6
% adsorbed

	Silt loam	Sandy loam	Silt loam	Sediment	Loam
5	8.12189	9.14112339	10.00494	13.99674	12.80665
5	7.21339	10.1427834	8.839762	13.21878	14.30259
average	7.66764	9.64195337	9.422349	13.60776	13.55462
s.d.	0.642407	0.70828056	0.823903	0.550106	1.057791
1	7.435657	11.563186	11.32127	14.86731	20.40122
1	7.569208	11.5217306	11.23156	14.93419	20.80847
average	7.502432	11.5424583	11.27641	14.90075	20.60485
s.d.	0.094435	0.02931335	0.063433	0.047288	0.287968
0.2	9.68523	12.3481378	13.94157	15.74803	22.08266
0.2		15.6410784	18.90628	15.26564	24.12736
average	9.68523	13.9946081	16.42393	15.50684	23.10501
s.d.	#DIV/0!	2.32846062	3.510582	0.341101	1.445823
0.04	8.538899	17.3913043	14.69868	15.27446	25.73529
0.04	11.56069	17.8823529	14.69868	15.63263	24.87333
average	10.0498	17.6368286	14.69868	15.45355	25.30431
s.d.	2.136731	0.34722379	0	0.253265	0.6095

Table 7
On soil

	Silt loam	Sandy loam	Silt loam	Sediment	Loam
5	0.24553	0.136	0.50604	0.30788	0.35269
5	0.12053	0.14769	0.39192	0.28341	0.46926
average	0.18303	0.141845	0.44898	0.295645	0.410975
s.d.	0.088388	0.00826608	0.080695	0.017303	0.082427
1	0.00956	0.02686	0.10623	0.05971	0.20227
1	0.01493	0.02845	0.10759	0.07012	0.21064
average	0.012245	0.027655	0.10691	0.064915	0.206455
s.d.	0.003797	0.0011243	0.000962	0.007361	0.005918
0.2	0.00971	0.00328	0.0258	0.01217	0.03711
0.2	0.00545	0.01589	0.04496	0.01047	0.04322
average	0.00758	0.009585	0.03538	0.01132	0.040165
s.d.	0.003012	0.00891662	0.013548	0.001202	0.00432
0.04	0.0009	0.00361	0.0051	0.0018	0.01058
0.04	0.00307	0.00432	0.0051	0.00172	0.01002
average	0.001985	0.003965	0.0051	0.00176	0.0103
s.d.	0.001534	0.00050205	0	5.66E-05	0.000396

Table 7

Total Solution		Silt loam	Sandy loam	Silt loam	Sediment	Loam
	5	0.79315	0.90942	0.97179	1.33754	1.17966
	5	0.79265	0.90461	0.97265	1.35371	1.19667
	average	0.7929	0.907015	0.97222	1.345625	1.188165
	s.d.	0.000354	0.00340118	0.000608	0.011434	0.012028
	1	0.1609	0.18787	0.19861	0.27309	0.24374
	1	0.16331	0.187105	0.19638	0.27394	0.24856
	average	0.162105	0.1874875	0.197495	0.273515	0.24615
	s.d.	0.001704	0.00054094	0.001577	0.000601	0.003408
	0.2	0.03229	0.03853	0.03971	0.05373	0.04868
	0.2	0.03229	0.03819	0.04002	0.05381	0.05027
	average	0.03229	0.03836	0.039865	0.05377	0.049475
	s.d.	0	0.00024042	0.000219	5.66E-05	0.001124
	0.04	0.00707	0.00852	0.00856	0.01159	0.01101
	0.04	0.00707	0.0086	0.00856	0.01153	0.01075
	average	0.00707	0.00856	0.00856	0.01156	0.01088
	s.d.	0	5.6569E-05	0	4.24E-05	0.000184

Table 7

%desorbed of adsorbed		Silt loam	Sandy loam	Silt loam	Sediment	Loam
	5	96.57	92.24	91.90	96.36	90.75
	5	97.04	98.16	92.50	97.19	91.86
average		96.81	95.20	92.20	96.78	91.31
	s.d.	0.34	4.18	0.42	0.58	0.79
	1	96.10	90.69	89.49	95.77	88.57
	1	96.17	90.65	89.53	96.33	88.61
average		96.13	90.67	89.51	96.05	88.59
	s.d.	0.05	0.03	0.03	0.40	0.03
	0.2	95.89	88.21	87.90	95.09	85.96
	0.2	95.85	87.82	87.19	95.91	85.84
average		95.87	88.02	87.54	95.50	85.90
	s.d.	0.03	0.28	0.50	0.58	0.09
	0.04	94.78	86.21	84.67	93.84	81.40
	0.04	96.09	83.11	84.67	95.79	84.51
average		95.43	84.66	84.67	94.81	82.95
	s.d.	0.92	2.19	0.00	1.38	2.20

Attachment 2

Structures of Parent and Transformation Products

RPA 412708
IUPAC name: (*S*)-5-Methyl-2-methylthio-5-phenyl-3,5-dihydroimidazol-4-one
CAS name: 4*H*-Imidazol-4-one, 3,5-dihydro-5-methyl-2-(methylthio)-5-phenyl-,(S)-
CAS #: N/A